MID-ATLANTIC REGION

Engineering Design Assistance Kit (DAKit) v.04

Filterra®

Stormwater Bioretention Filtration System

Manufactured by:

Toll Free: (866) 349 3458
Fax: (804) 752 6838
www.Filterra.com
E: design@filterra.com

Introduction and Scope of this Document

At federal, state and local level, stormwater management is increasingly important. Americast's Filterra® units can help developers comply with NPDES legislation by removing pollutants, using a small, efficient natural system that is both cost-effective and reliable.

This document is compiled to assist engineers in the proper design for the best results where Filterra® is used for stormwater quality management. We want your project to be successful and it is important to this success that you follow guidelines contained herein. Please review the essential reading section (p.4).

It is essential to:

- Adhere to the Design Guidelines, p.7
- Size the Filterra® unit correctly, using the regional Sizing Table, p.15
- Add Flowline detail (p.10), Gutter detail (p.11) and Plan Notes (p.29) to your plans
- Complete the Project Information Sheet (p.9) & submit with plans to Americast for review before permitting. **THIS REVIEW IS MANDATORY** for warranty to apply and helps ensure that each Filterra® system operates efficiently to maximize performance and minimize maintenance.

Other documents available on request include:

Technical Whitepaper	Scientific paper more fully explaining processes occurring within the system
Installation Help	Short document for contractors to aid correct installation
Installation, Operation & Maintenance Manual	Owner's manual presenting technical and operational details.

Table of Contents

Section A

Essential Reading – Filterra® Overview

Important !

Please remember to complete and send the Project Information Sheet (p.9) to Filterra® with plans for evaluation. This review is mandatory as proper placement ensures optimum performance and validates the product warranty.

Filterra® Overview

Stormwater Bioretention Filtration System

Save valuable space with small footprint for urban sites

Improve BMP aesthetics with attractive trees or shrubs

Reduce lifetime costs with safer and less expensive maintenance

Remove Pollutants and Comply with NPDES

Filterra® is well-suited for the ultra-urban environment with high removal efficiencies for many pollutants such as petroleum, heavy metals, phosphorus, nitrogen, TSS and bacteria. Filterra® is similar in concept to bioretention in its function and applications, with the major distinction that Filterra® has been optimized for high volume/flow treatment and high pollutant removal. It takes up little space (0.33% FSA/DA) and may be used on highly developed sites such as landscaped areas, green space, parking lots and streetscapes. Filterra® is exceedingly adaptable and is the urban solution for Low Impact Development.

Stormwater flows through a specially designed filter media mixture contained in a landscaped concrete container. The filter media captures and immobilizes pollutants; those pollutants are then decomposed, volatized and incorporated into the biomass of the Filterra® system's micro/macro fauna and flora. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged. Higher flows bypass the Filterra® via a downstream inlet structure or other appropriate relief.

Expected Pollutant Removal Rates

(Based on a 0.33% FSA/DA ratio in Mid-Atlantic Region)

Annual Volume Filtered	90%
TP Removal	74%
TN Removal	68%
TSS Removal	88%
Metal Removal	82%

AMERICAST®

Bioretention
Plant/Soil/Microbe Complex
Removes Pollutants, TSS,
Phosphorous, Nitrogen, Heavy
Metals, Hydrocarbons, etc.

New or Existing
Catch Basin, Curb Cut
or Other Means of
Overflow Relief

Curb and
Gutter

High Flow
Bypass

Filterra® at Higher
Elevation than Bypass

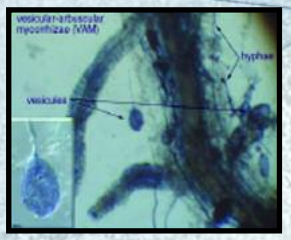
Plant/Tree

Tree Grate

Clean-out

3" Mulch

Root Uptake



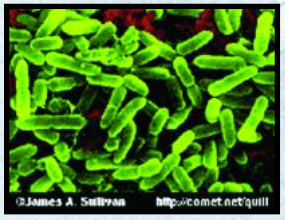
Storm Water Inflow
("First Flush")

Concrete
Filterra®
Container

Engineered
Media

Roadway/Parking Lot

Biodegradation



Treated Stormwater
Underdrain System

filterra®

A Growing Idea in Stormwater Filtration.

U.S. Patent #6,277,274
#6,569,321

Design Guidelines for Using Filterra®

1. Do not place in a sump condition. The Filterra® cannot be used as a stand alone inlet – it will need effective bypass during higher intensity rainfall events.
   Plans MUST show Filterra® Top Curb (TC) and Flow Line (FL) spot elevations and also bypass TC (where applicable) and FL spot elevations.
   The Filterra® TC and FL elevations MUST be higher than the bypass TC and FL elevations for effective bypass. Use Drawing FLR-2 (p.10) as a detail on the project plans.

2. For proper trash collection ensure a minimum 4" and maximum 6" Filterra® throat opening depth and use Drawing CGT-03 (p.11) as a detail on the project plans.

3. Do not direct surface flow to the Filterra® in a "head-on" configuration. Refer to Guidelines GU1-A (p.12) and GU2 (p.13) for grading design that encourages flow to enter a Filterra® in a cross linear flow – left-to-right or right to-left in the gutter in front of the throat, as per a wet curb and prevents system damage. During extreme storm events the excess flow should continue past the Filterra® to a bypass inlet or other means of relief. Guideline GU3, Parking Lot Corners, shows common situations (p.14).

4. To calculate which size Filterra® is required, use Table 1, Filterra® Quick Sizing Table, appropriate to the project's geographical region (p.15). The entire contributing drainage area to the Filterra® should be considered impervious. This is because urban soils are highly compacted and essentially act as impervious surfaces. The maximum contributing drainage area is 0.5 acres. Select the appropriate box size to maintain the optimum filter surface area to drainage area ratio (i.e. minimum 0.33% for the Mid-Atlantic region). Further information relating to sizing can be found in the Filterra® Technical Whitepaper at www.filterra.com.

5. To ensure correct installation, include the Standard Filterra® Plan Notes (p.29) on your Filterra® detail project sheet.

7. Send plans and the completed Filterra® Project Information Sheet (p.9) to Americast for Filterra® placement review. Plans sheets should include grading, drainage areas, stormwater schedules and Filterra® details. **THIS REVIEW IS MANDATORY** for warranty to apply and helps ensure that each Filterra® system operates efficiently to maximize performance and minimize maintenance. Our staff also looks for value engineering opportunities.

Methods of sending information for review are as follows:

Email: design@filterra.com
AutoCAD or PDF files
Fax: (804) 752-6838
Toll Free: (866) 349-3458

Mail or other:
Americast - Filterra Review
11352 Virginia Precast Road
Ashland, Virginia 23005

Items Considered in Americast's Filterra® Plan Reviews

Following is a summary list of the items Americast considers during plan review. Plans sheets should include grading, drainage areas, stormwater schedules and Filterra® details.

Notes

- Filterra® Structure Label or Identification Number
- Planned Filterra® Box Size
- Filterra® Contributing Drainage Area (not the bypass inlet Drainage Area)

Checks

- The planned Filterra® box size meets project's regional sizing specification
- Spot elevations (Top Curb & Flow Line) for Filterra® and bypass (TC & FL)
- The Filterra® spot elevations (TC & FL) are higher than bypass spot elevations
- The grading design encourages cross linear flow and not head-on flow
- Filterra® invert elevations are shown (3.5' below TC)
- The Filterra® outlet drain pipe is sized correctly
- The outlet drain pipe exits perpendicular to the Filterra® wall
- For any conflicting structures such as storm drain pipes below Filterra®
- For most efficient placement of Filterra® units
- Plans include Filterra® details listed below:

  FLR-2: Filterra® Typical Flow Line Relationship Required for Effective Bypass

  CGT-03: Filterra® Throat Opening and Gutter or Flume Detail

  Filterra® Standard Plan Notes

PLEASE PRINT AND FAX OR EMAIL THIS FORM
AN INTERACTIVE PDF FORM IS AVAILABLE ON THE DAKIT CD FOR EASY EMAILING

Filterra® Project Information Sheet

Complete & send to Americast by email, fax or mail.

Address: 11352 Virginia Precast Road
Ashland, VA 23005
Toll Free: (866) 349 3458
(804) 798-6068
Fax: (804) 752-6838
Email: design@filterra.com

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A Growing Idea in Stormwater Filtration.

Engineering Contact Information

Engineering Firm:	Current Date:
Contact:	Phone:
Email:	Fax:

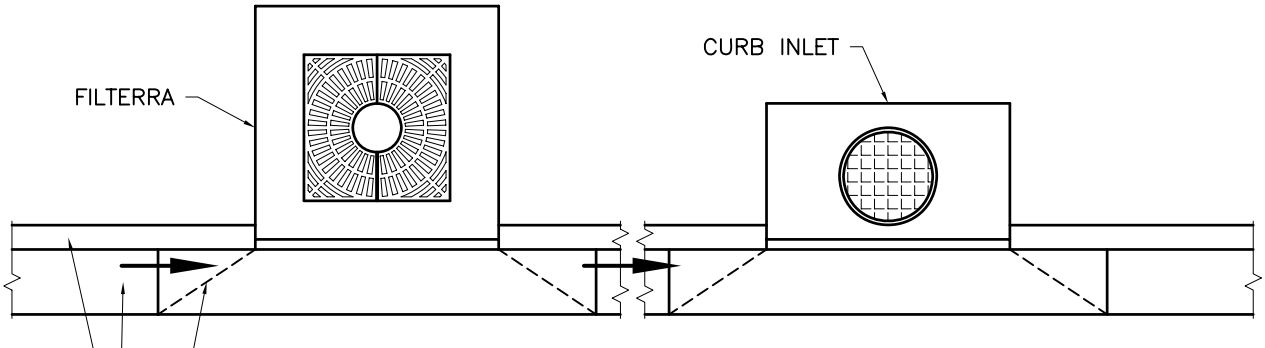
Project Information

Project Name/number:	Regulatory Municipality and State (city, county, etc.):

Filterra® Details (Email, mail or fax plans to Americast - Acceptable formats are AutoCAD or pdf)
Plans sheets should include grading, drainage areas, stormwater schedules and Filterra® details.

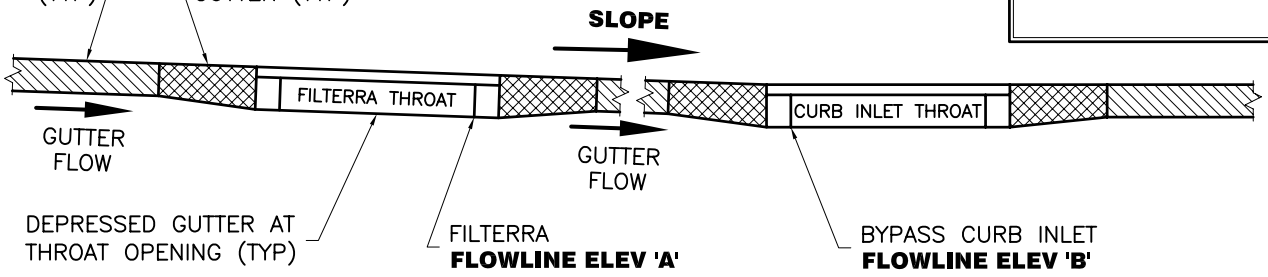
Filterra® Structure ID	Internal L x W (ft) Dimensions	Filterra® Spot Elevations TC	FL	Filterra® Drainage Area (ac)	Bypass ID	Bypass Spot Elevations TC	FL

TC = Top Curb , FL = Flow Line
F☐ Detail on plans CGT Detail on plans ☐ FT Plan Notes shown ☐

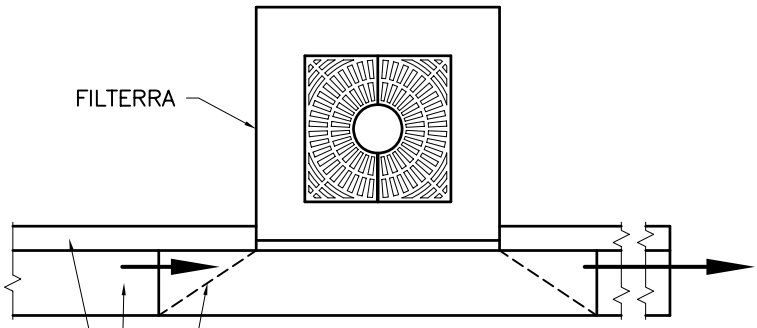


PLAN VIEW

ELEV 'A' MUST BE HIGHER THAN ELEV 'B'

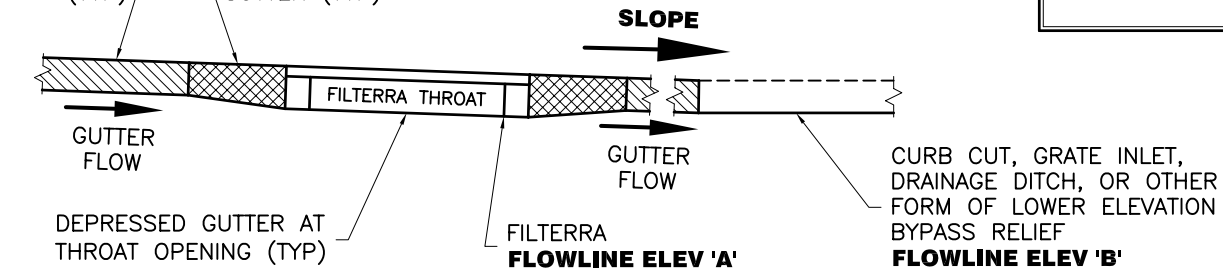


ELEVATION VIEW



PLAN VIEW

ELEV 'A' MUST BE HIGHER THAN ELEV 'B'



ELEVATION VIEW

DRAWING AVAILABLE IN TIF FILE FORMAT.

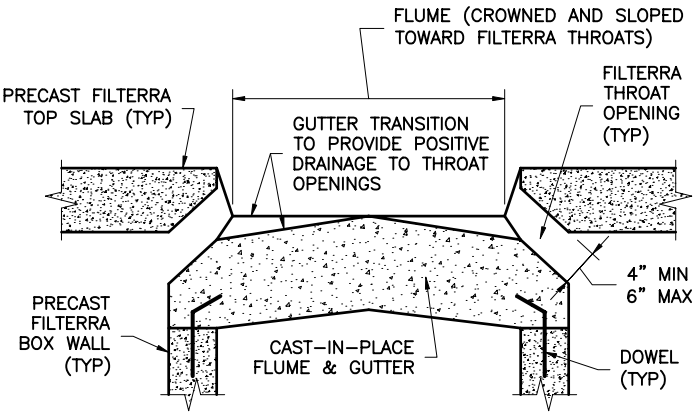
AMERICAST®

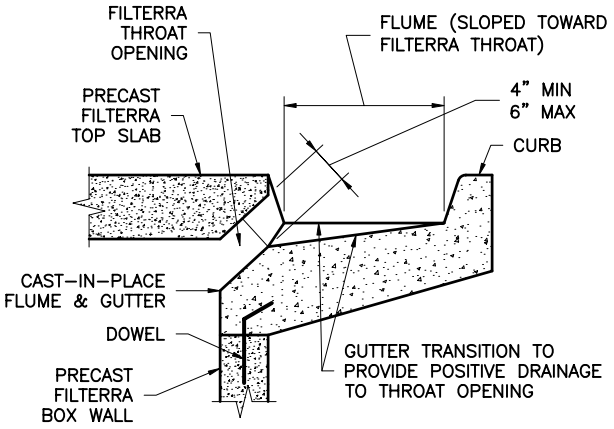
DATE: 05–09–05 | DWG: FLR–2

FILTERRA® TYPICAL FLOWLINE RELATIONSHIP FOR REQUIRED EFFECTIVE BYPASS

filterra®

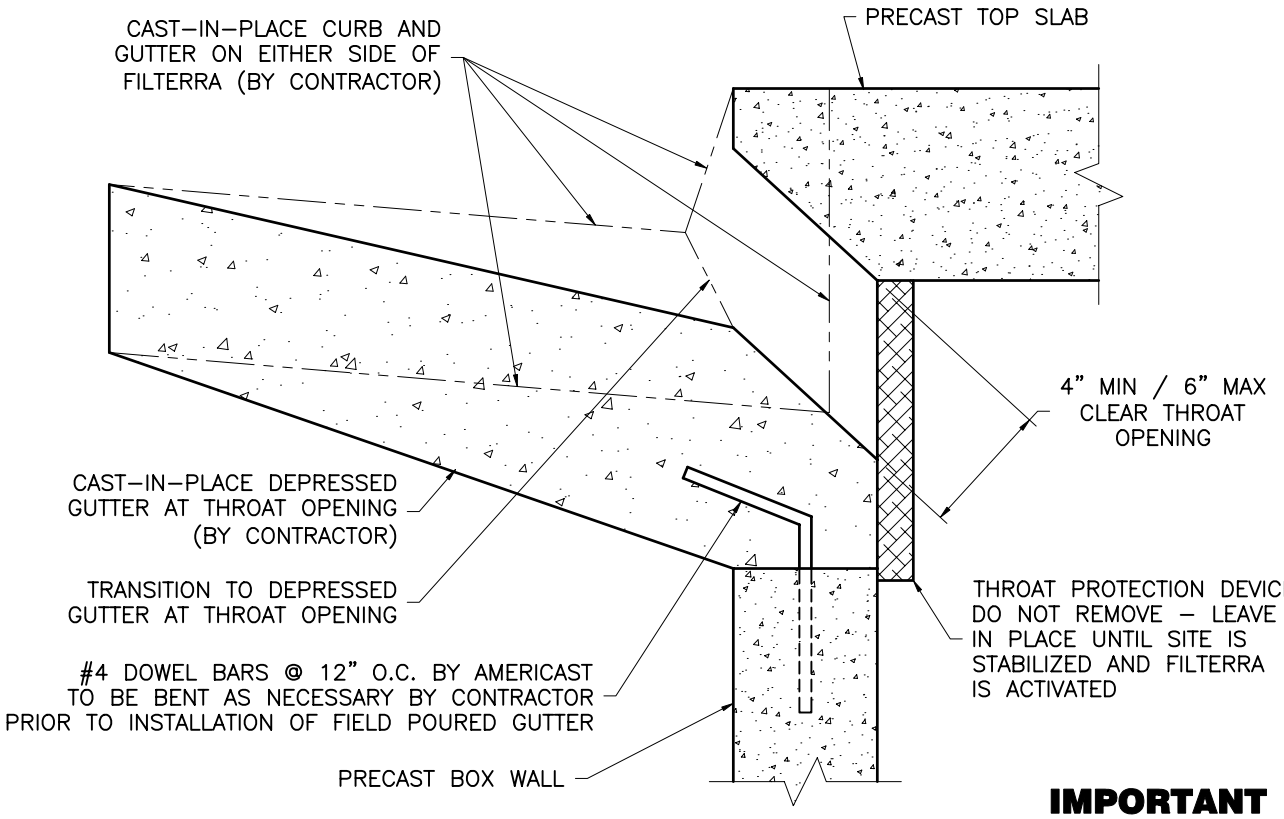
US PAT 6,277,274 AND 6,569,321





SECTIONS VIEWS OF FILTERRA IN FLUME APPLICATIONS

SEE BELOW FOR DETAILS NOT SHOWN



SECTION VIEW
FILTERRA THROAT OPENING

IMPORTANT

FILTERRA FLOWLINE MUST BE AT A HIGHER ELEVATION THAN BYPASS FLOWLINE (DROP INLET OR OTHER)

DRAWING AVAILABLE IN TIF FILE FORMAT.

AMERICAST®

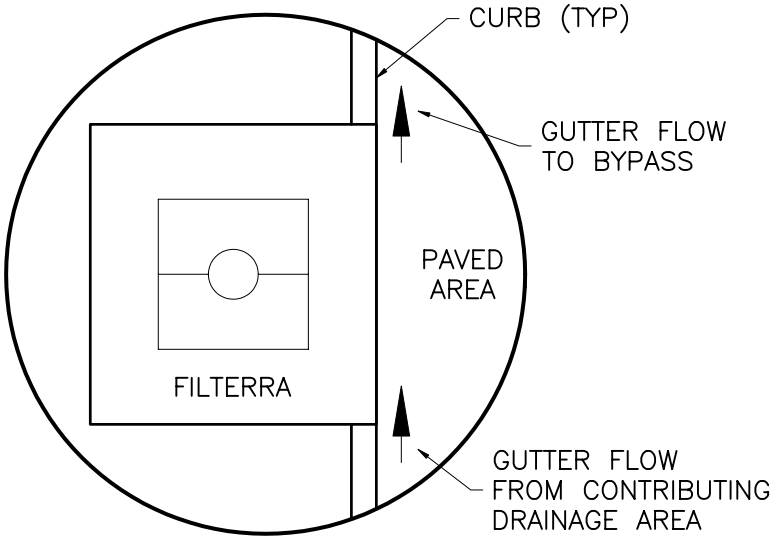
DATE: 02-23-05 | DWG: CGT-3

FILTERRA® THROAT OPENING AND GUTTER OR FLUME DETAIL

filterra®

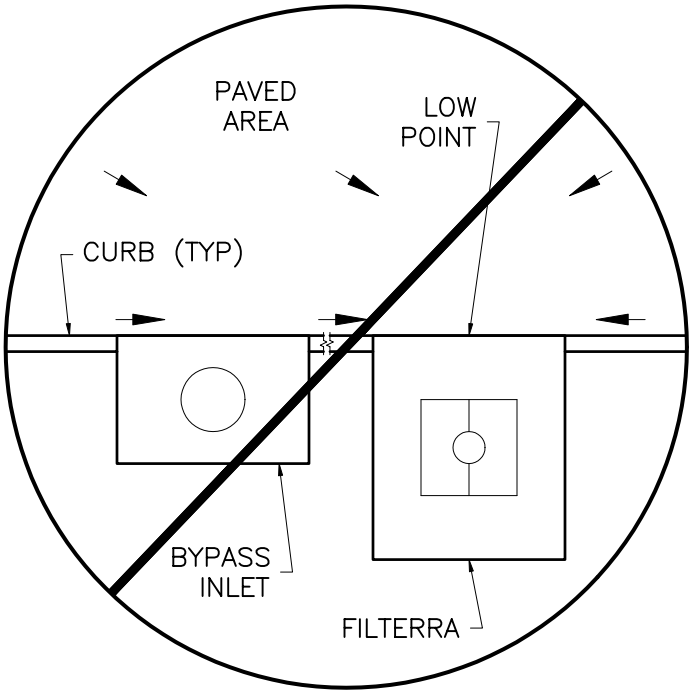
US PAT 6,277,274 AND 6,569,321

GRADING AND GUTTER FLOW



GUTTER FLOW

GRADING AND CURB AND GUTTER SHOULD BE SUCH THAT GUTTER FLOW APPROACHES THE FILTERRA FROM ONE SIDE OF THE THROAT AND FLOWS AWAY FROM THE FILTERRA ON THE OPPOSITE SIDE DURING EXTREME STORM EVENTS. DESIGN OR INSTALLATION SUCH THAT FLOW APPROACHES FROM BOTH SIDES WILL RESULT IN SITE MAINTENANCE ISSUES AND VOID MANUFACTURER'S MAINTENANCE PROGRAM AND WARRANTY.



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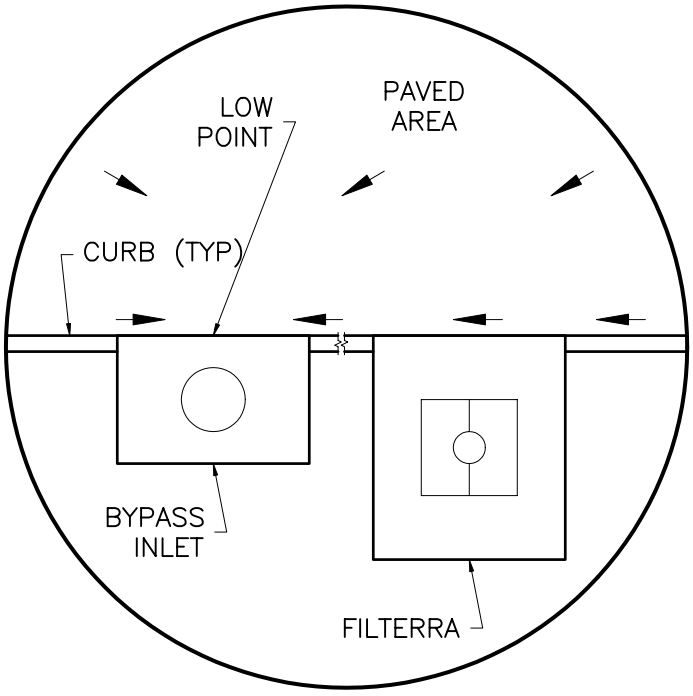


CORRECT

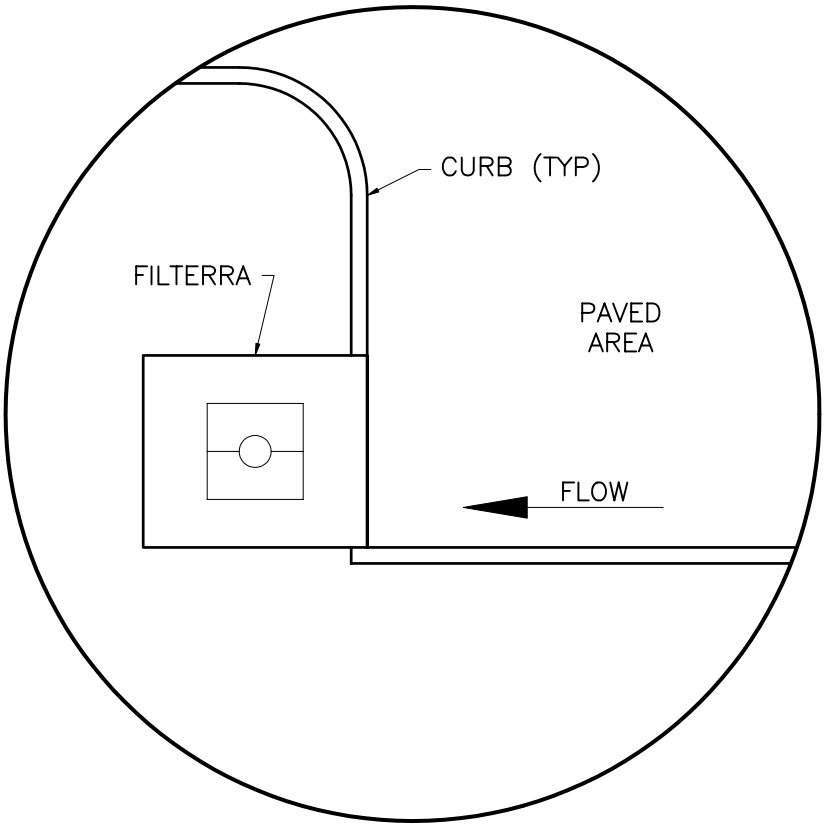
AMERICAST®

DATE: 03–03–05 | DWG: GU1–A

FILTERRA® GUIDELINES
GRADING AND GUTTER FLOW

filterra®
US PAT 6,277,274
AND 6,569,321

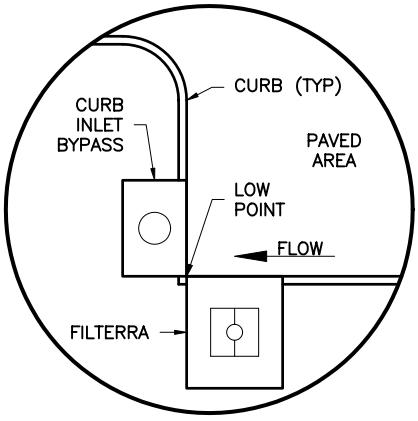
AVOID "HEAD-ON" GUTTER FLOW

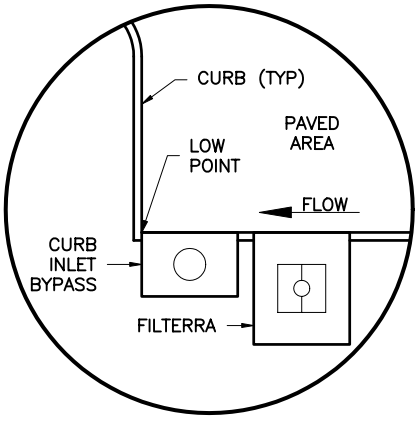


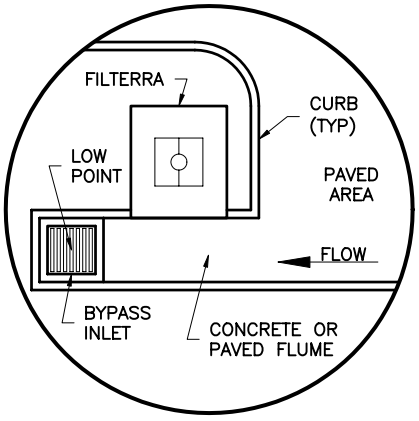
PROBLEM

FLOW FROM THE ADJACENT GUTTER HITS THE FILTERRA "HEAD–ON". THIS CAN CAUSE SYSTEM DAMAGE (MEDIA EROSION OR SUSPENSION). REGARDLESS OF WHETHER BYPASS IS PROVIDED THIS IS A PROBLEM SCENARIO.

GUTTER FLOW SHOULD APPROACH THE FILTERRA PARALLEL TO THE THROAT SO THAT WATER FLOWS IN A LINEAR PATTERN IN FRONT OF THE THROAT. DURING EXTREME STORM EVENTS, EXCESS WATER SHOULD CONTINUE TO FLOW IN FRONT OF THE FILTERRA TO A BYPASS INLET OR OTHER RELIEF.







POSSIBLE SOLUTIONS

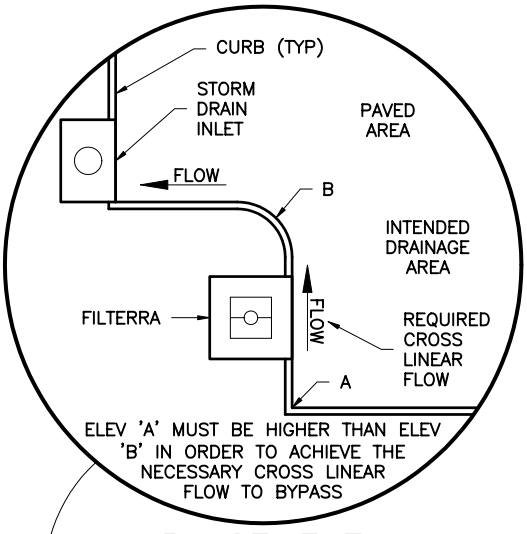
AMERICAST®

DATE: 12–22–04 | DWG: GU2

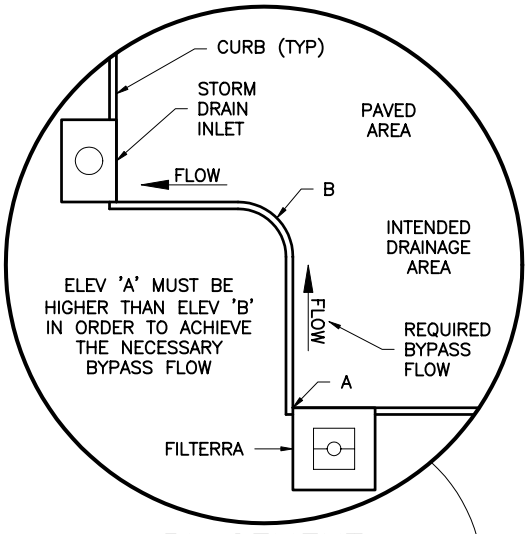
FILTERRA® GUIDELINES
AVOID "HEAD-ON" GUTTTER FLOW

filterra®
US PAT 6,277,274 AND 6,569,321

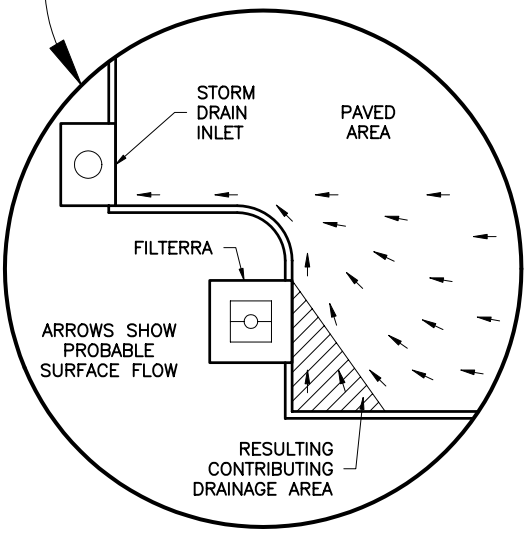
PARKING LOT CORNERS



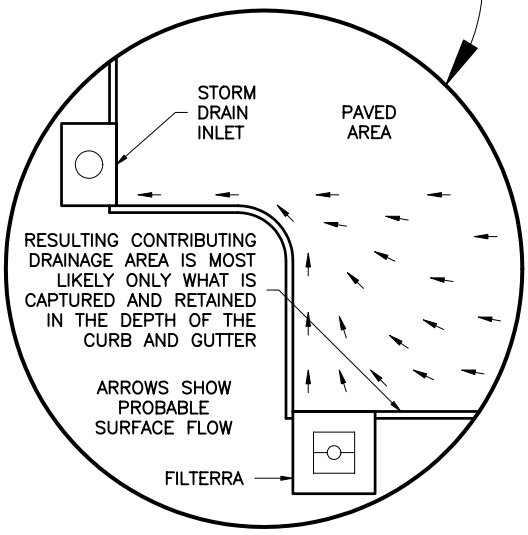
PLACEMENT



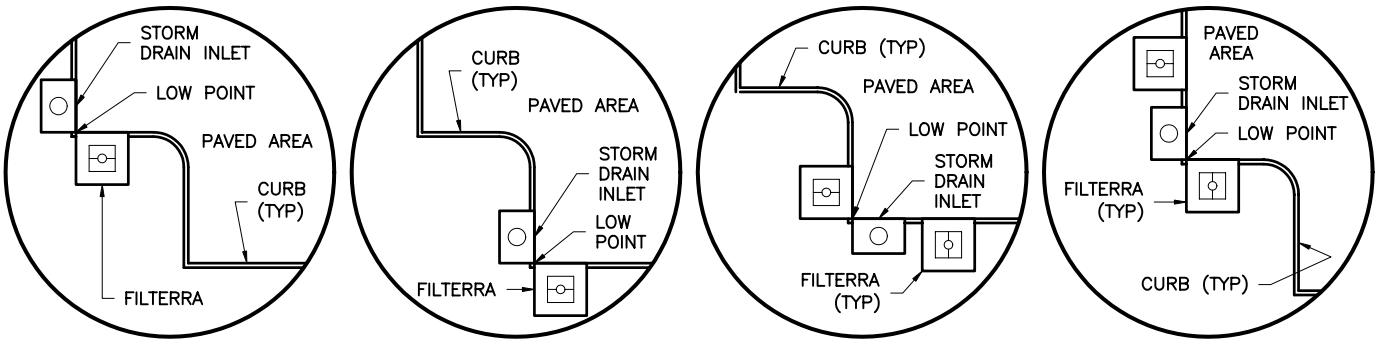
PLACEMENT



PROBLEM



PROBLEM



POSSIBLE PLACEMENT SOLUTIONS

AMERICAST®

DATE: 12–14–04 | DWG: GU3

FILTERRA® GUIDELINES
PARKING LOT CORNERS

filterra®
US PAT 6,277,274 AND 6,569,321

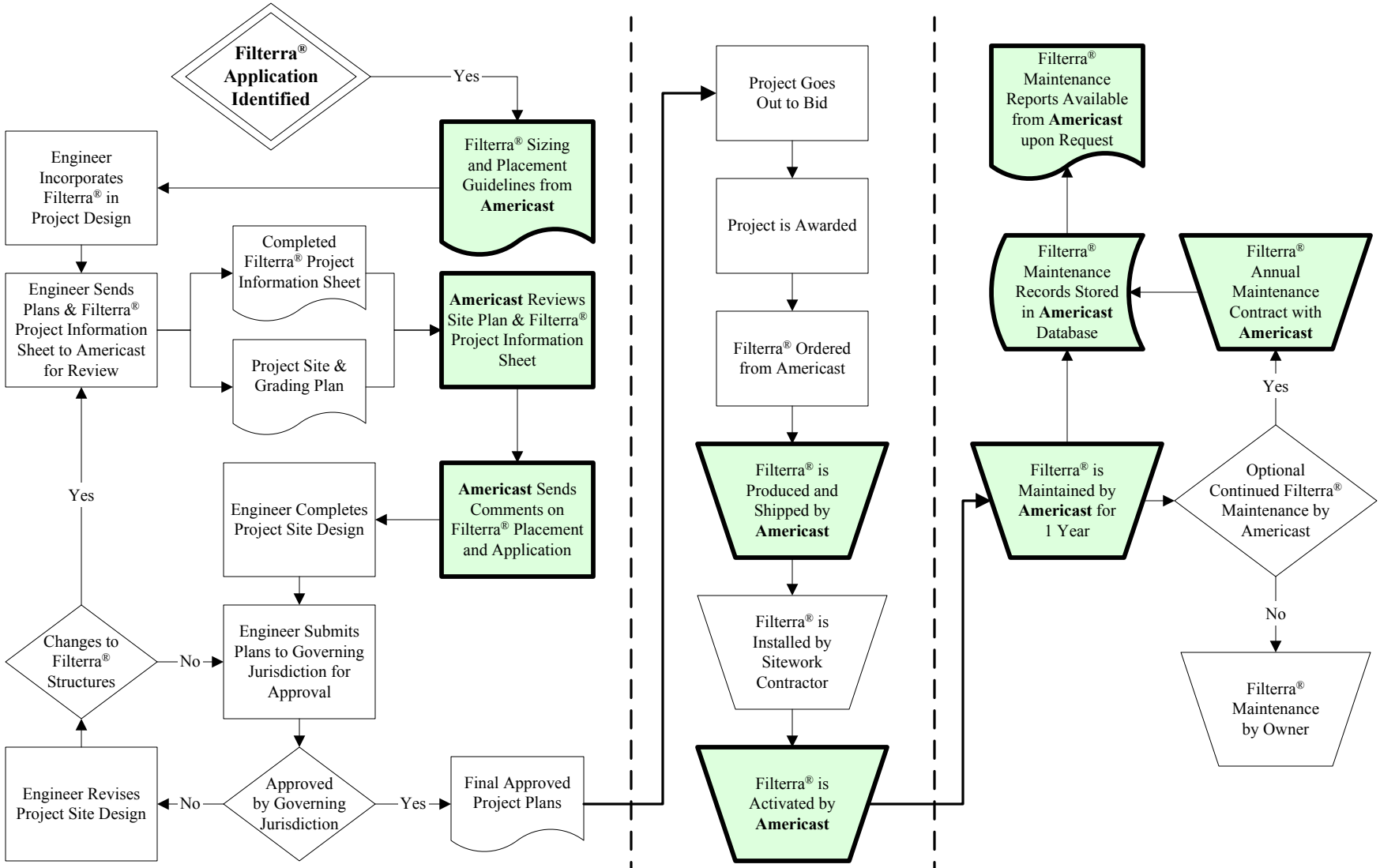
Table 1: Filterra® Quick Sizing Table
(Mid-Atlantic Region)

Available Filterra® Box Sizes (feet)	Total Contributing Drainage Area (acres)	Outlet Pipe
4x6 or 6x4	up to 0.17	4" SDR-35 PVC
4x8 or 8x4	0.18 to 0.22	4" SDR-35 PVC
Standard 6x6	0.23 to 0.25	4" SDR-35 PVC
6x8 or 8x6	0.26 to 0.33	4" SDR-35 PVC
6x10 or 10x6	0.34 to 0.42	6" SDR-35 PVC
6x12 or 12x6	0.43 to 0.50	6" SDR-35 PVC

Notes:

1. Consider the entire contributing Drainage Area to the Filterra® (not just the impervious area)
2. All boxes are a standard 3.5 feet depth (INV to TC)
3. A standard SDR-35 PVC pipe coupling is cast into the wall for easy connection to discharge drain
4. Dimensions shown are internal. Please add 1' to each for external (using 6" walls)
5. For more details, please see the Filterra® Technical Whitepaper at www.filterra.com

Filterra® Project Process Flowchart - Design to Maintenance



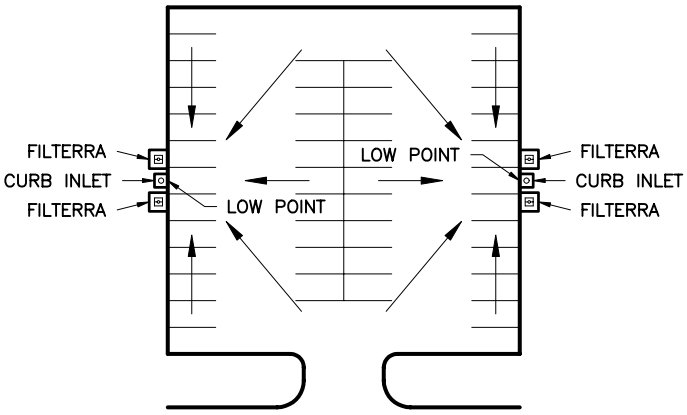
Bold items indicate services provided by Americast.

01/04/05

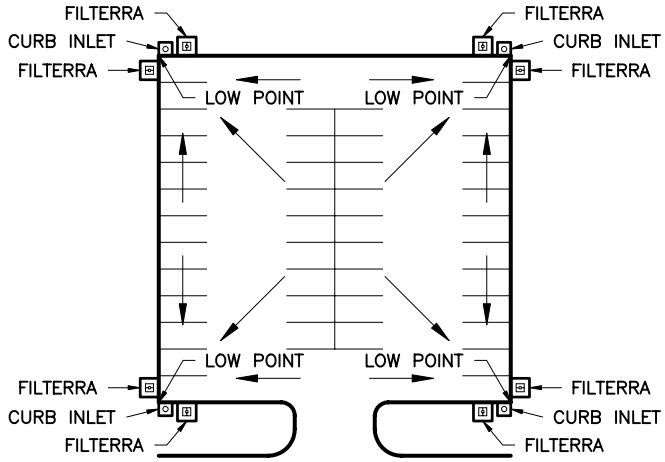
Section B

Filterra® Plans, Placement & Grading

Scenario Ideas to Ensure
Maximum Efficiency

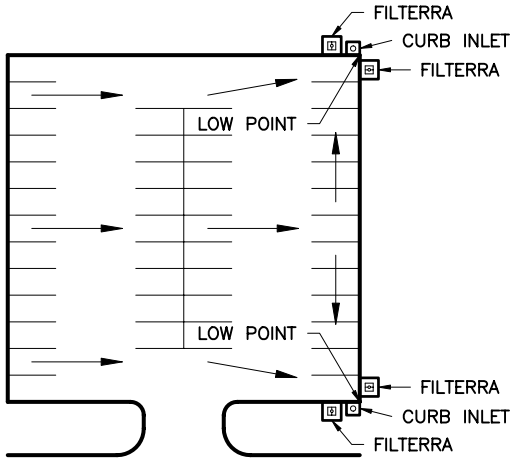


LOW POINTS AT 2 SIDES



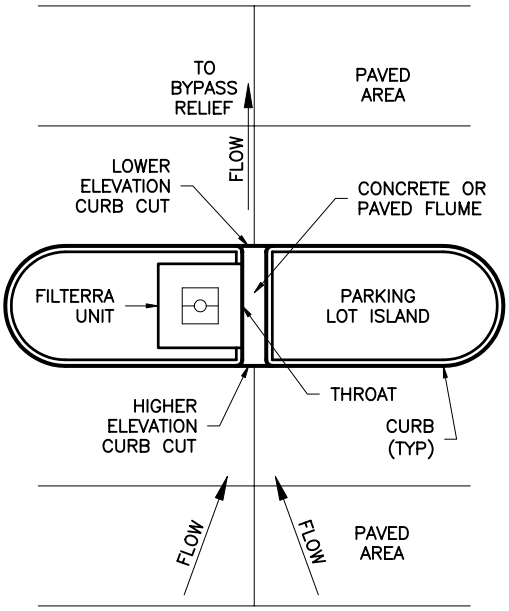
LOW POINTS AT 4 CORNERS

ARROWS INDICATE
DIRECTION OF SURFACE
DRAINAGE FLOW

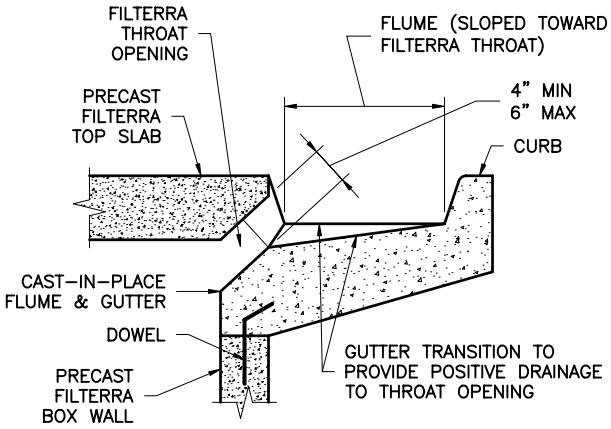


LOW POINTS AT 2 CORNERS

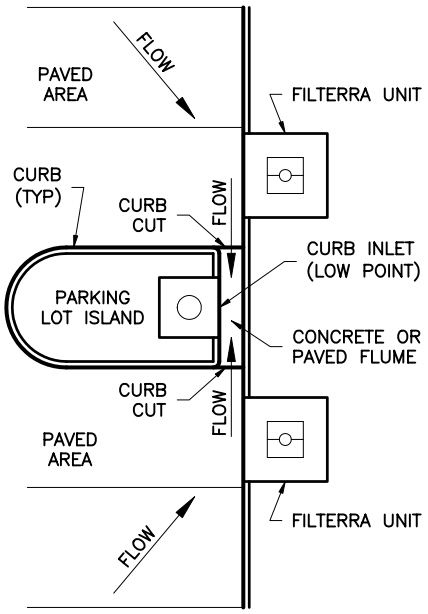
AMERICAST®	DATE: 01–03–05	DWG: PLG1
	FILTERRA® EXAMPLE SCENARIOS **TYPICAL PARKING LOT APPLICATIONS**	filterra® US PAT 6,277,274 AND 6,569,321



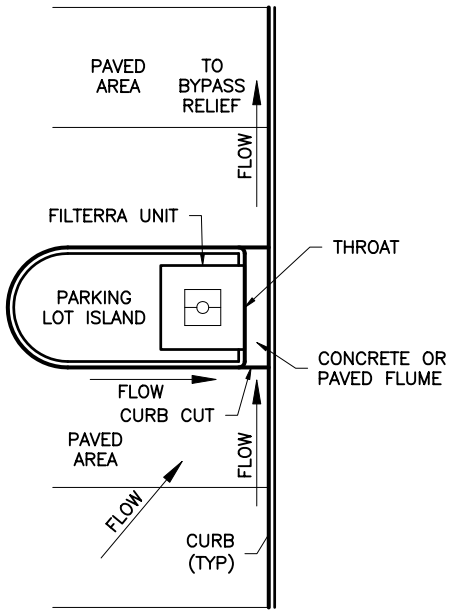
ON–GRADE ISLAND
IN OPEN PARKING LOT



SECTION VIEW OF FILTERRA
THROAT AND FLUME



LOW POINT ISLAND
AT SIDE OF PARKING LOT



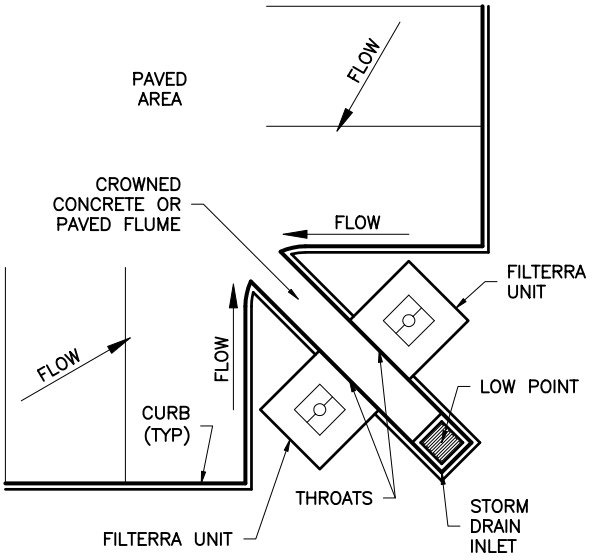
ON–GRADE ISLAND
AT SIDE OF PARKING LOT

AMERICAST®

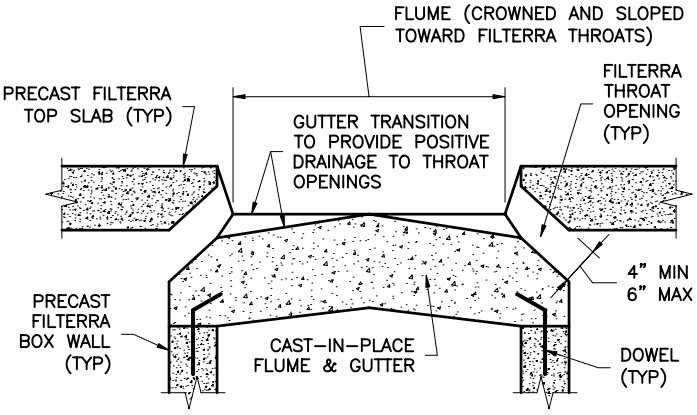
DATE: 01–03–05 | DWG: PLG2

FILTERRA® EXAMPLE SCENARIOS
PARKING LOT ISLAND APPLICATIONS

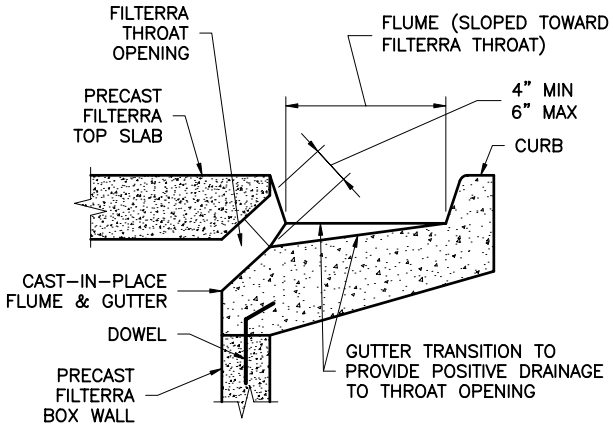
filterra®
US PAT 6,277,274
AND 6,569,321



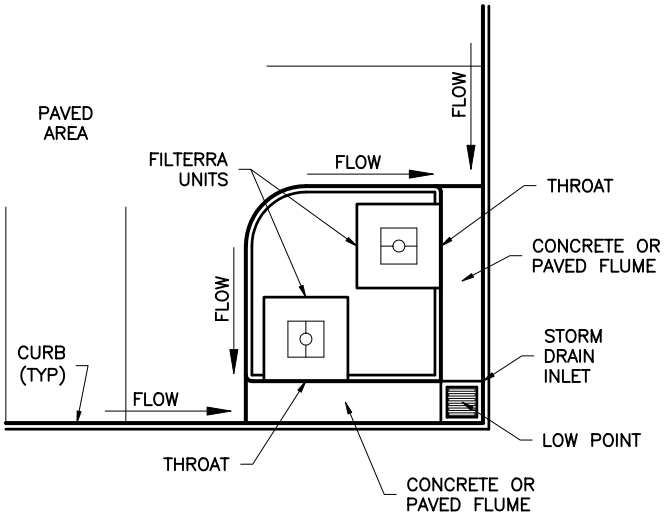
CROWNED FLUME CORNER



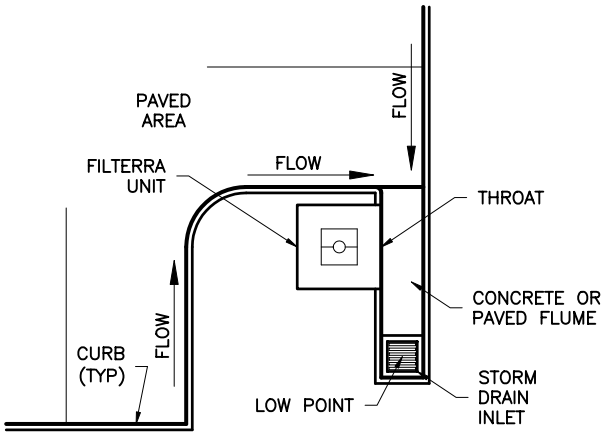
SECTION VIEW OF CROWNED FLUME



SECTION VIEW OF FILTERRA THROAT AND FLUME



TWO FLUME CORNER



ONE FLUME CORNER

AMERICAST®

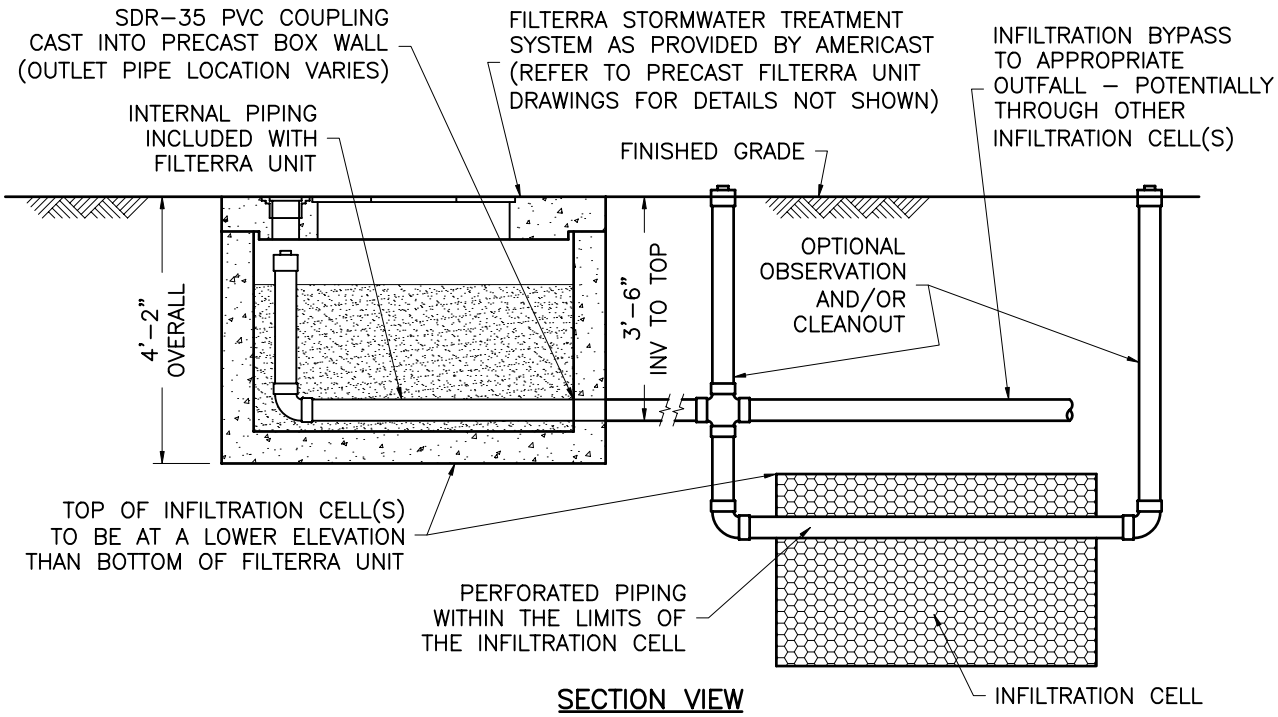
DATE: 01-03-05 | DWG: PLG3

FILTERRA® EXAMPLE SCENARIOS

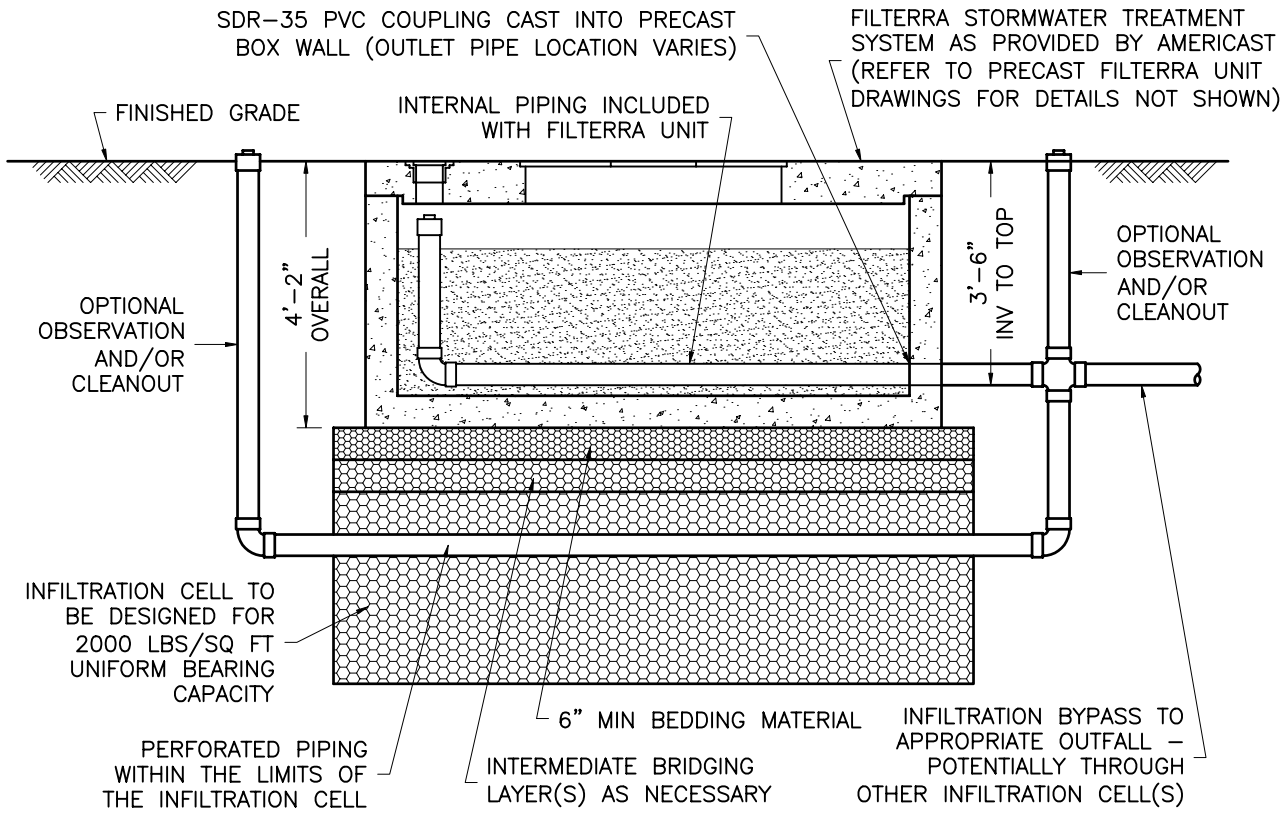
PARKING LOT CORNER APPLICATIONS

filterra®

US PAT 6,277,274 AND 6,569,321



SECTION VIEW
REMOTE INFILTRATION CELL



SECTION VIEW
INFILTRATION CELL BENEATH FILTERRA

DRAWING AVAILABLE IN TIF FILE FORMAT.

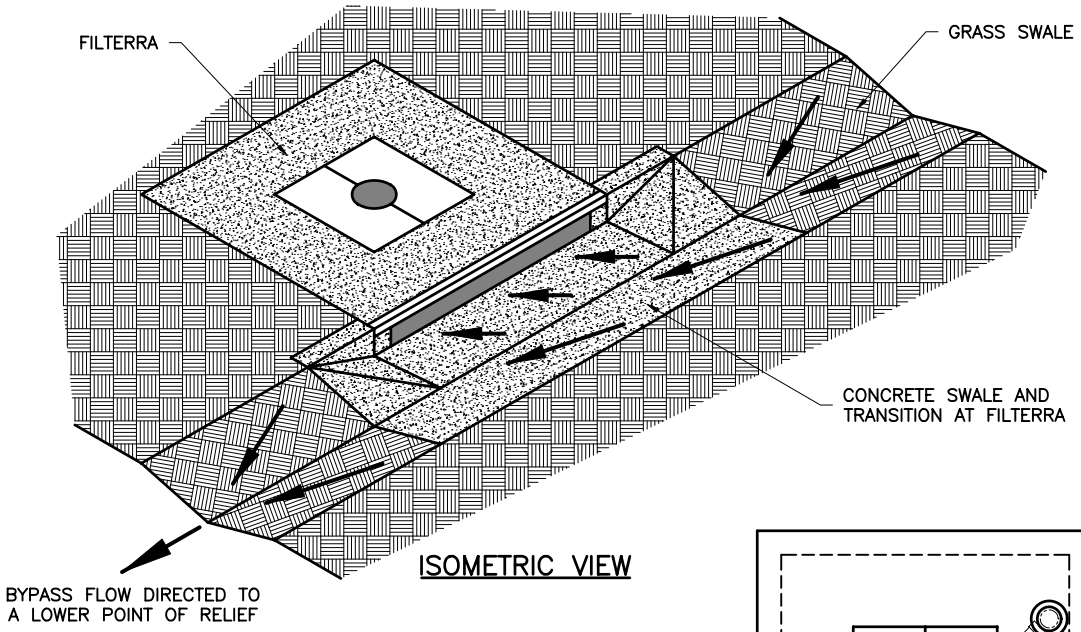
AMERICAST®

DATE: 02–22–05 | DWG: FTINF–1

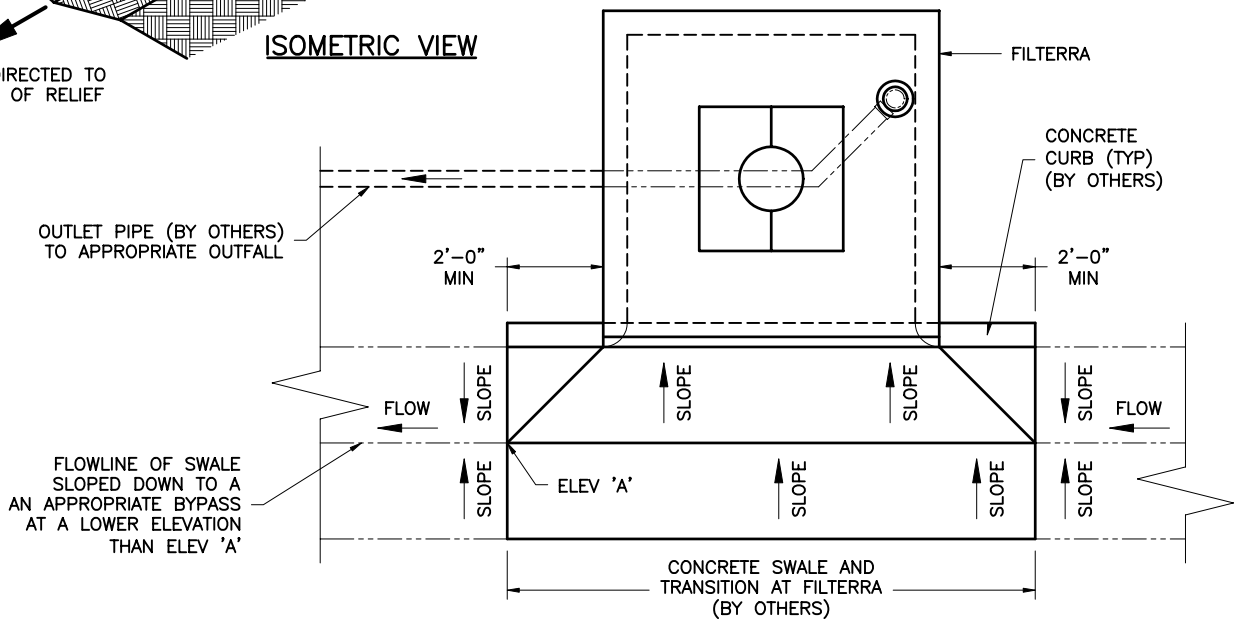
PRECAST FILTERRA® FOR INFILTRATION APPLICATIONS

filterra®

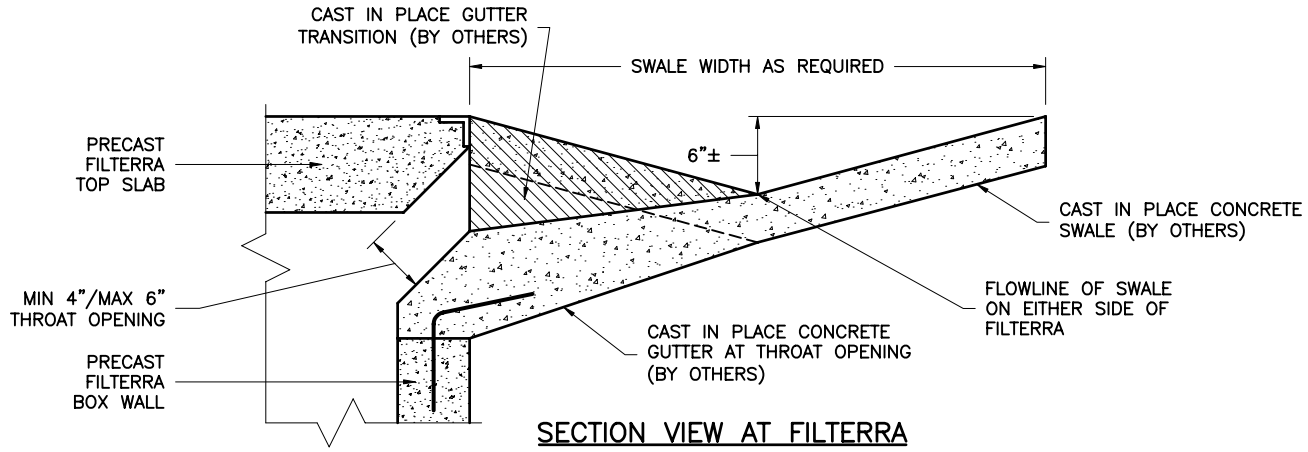
US PAT 6,277,274 AND 6,569,321



ISOMETRIC VIEW



PLAN VIEW



SECTION VIEW AT FILTERRA

DRAWING AVAILABLE IN TIF FILE FORMAT.

AMERICAST®

DATE: 03–10–05 | DWG: FTSWL–1

PRECAST FILTERRA® UNIT TYPICAL SWALE CONFIGURATION

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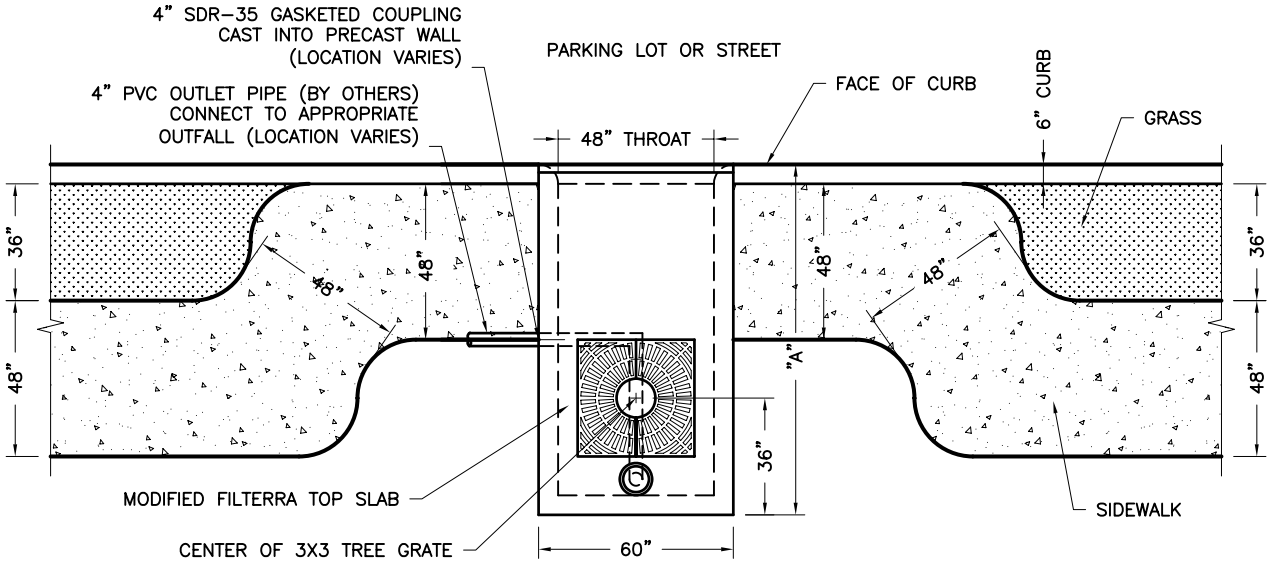
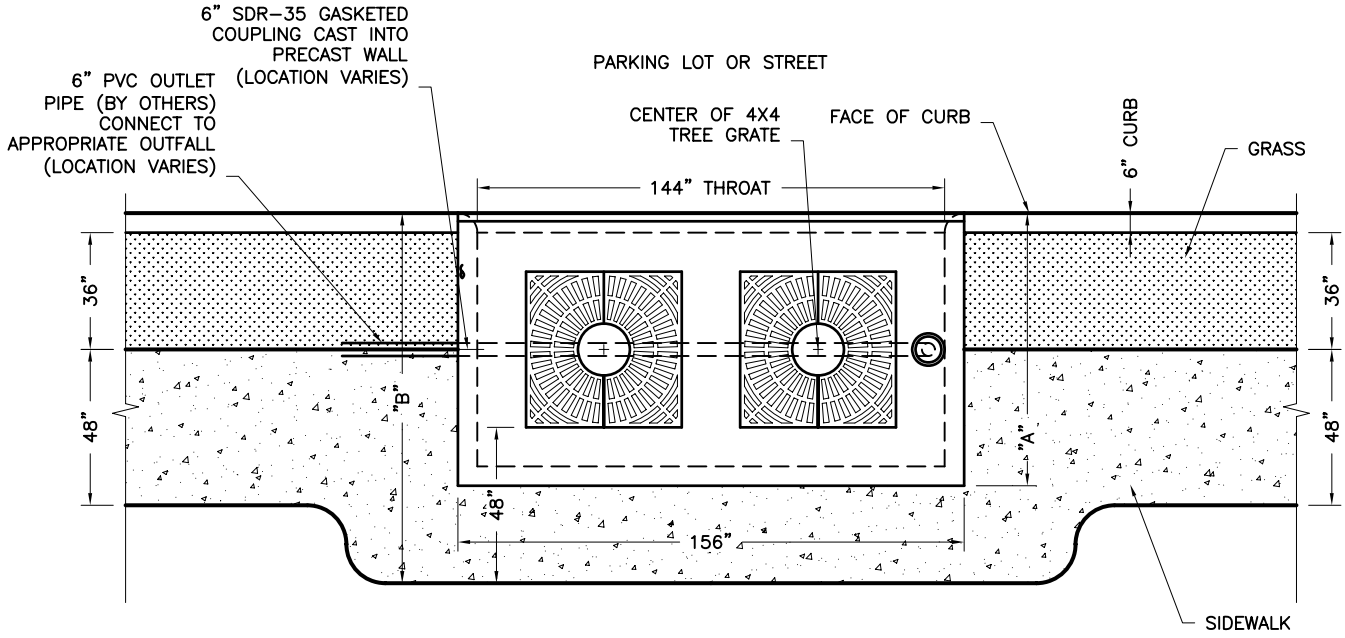
AND 6,569,321



BOX SIZE	DIM. "A"
4X8 & 6X8	9'–0"
6X10	11'–0"

MODIFIED NARROW LENGTH FILTERRA UNIT

ONLY FOR 4X8 (SHOWN) 6X8 AND 6X10 BOXES



BOX SIZE	DIM "A"	DIM "B"
6X4 & 8X4	5'–0"	8'–0"
6X6 & 8X6	7'–0"	9'–0"
10X6 & 12X6	7'–0"	9'–6"

STANDARD NARROW WIDTH FILTERRA UNIT

SUITABLE FOR ALL STANDARD BOXES

AMERICAST®

TOLL FREE (866) 349-3458

DATE: 03–25–05 | DWG: FTSC–1

TYPICAL FILTERRA® SIDEWALK CONFIGURATIONS

filterra®

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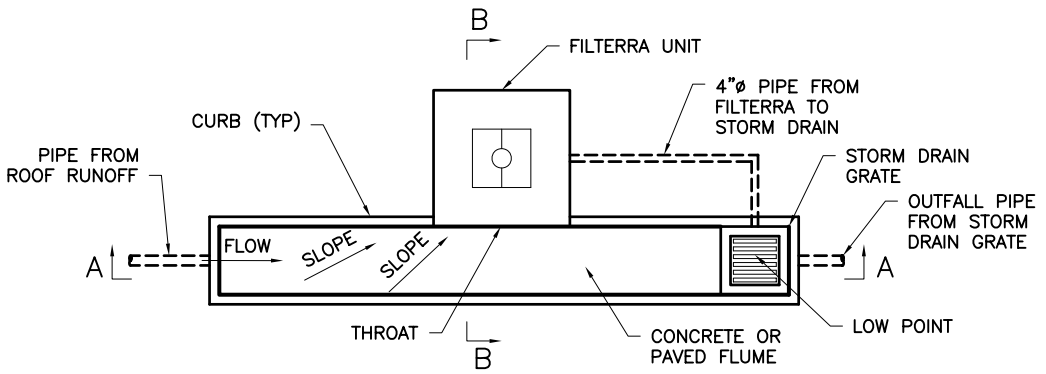
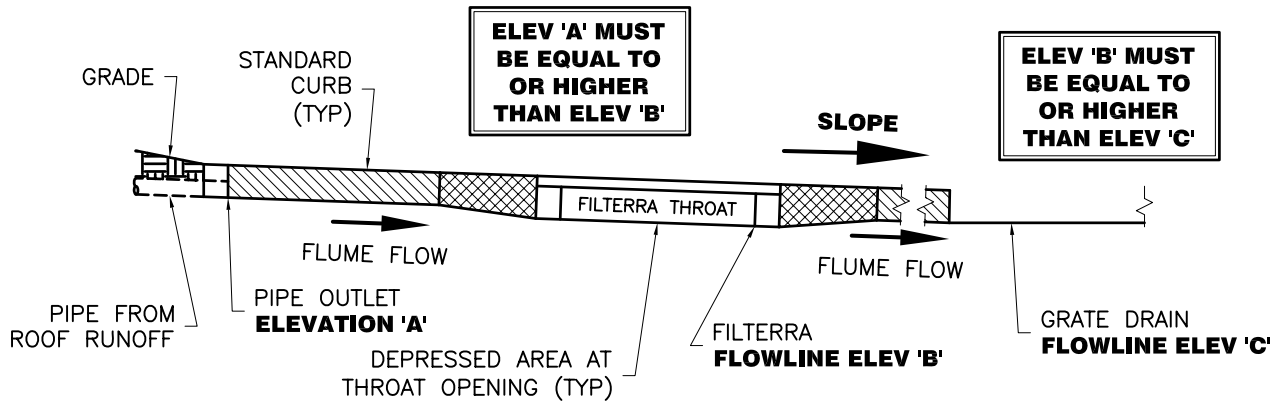
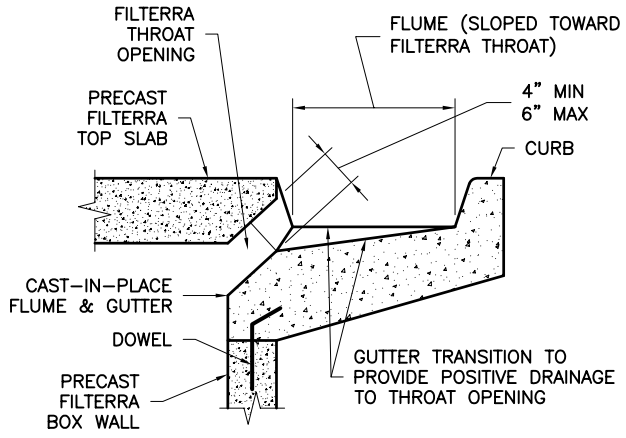


FLUME PLAN



FLUME CROSS SECTION A–A



FLUME SECTION B–B

AMERICAST®

DATE: 03–17–05 | DWG: FTRDF–1

FILTERRA® EXAMPLE SCENARIOS

ROOF DRAIN FLUME APPLICATION

filterra®

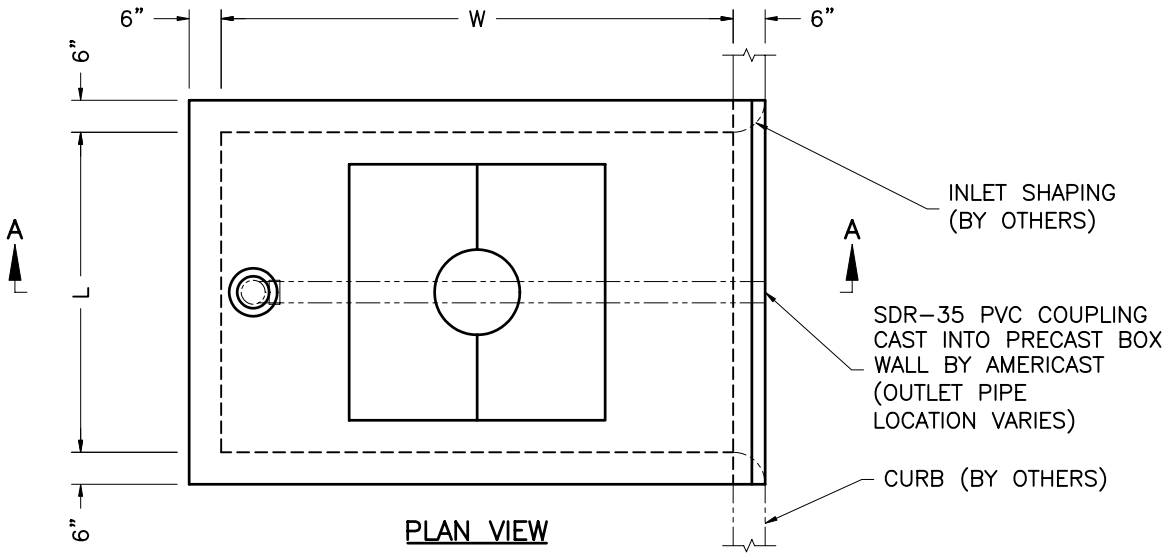
US PAT 6,277,274 AND 6,569,321

Section C

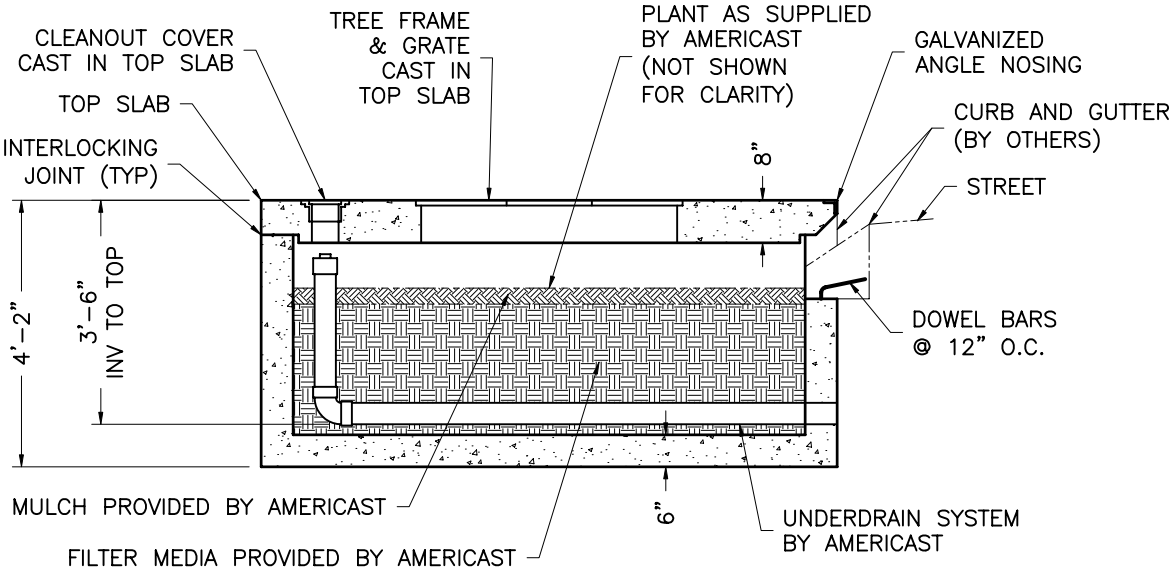
Standard Filterra® Detail Drawings & Filterra® Plan Notes

For TIF versions of these detail drawings,
please contact Americast Toll Free: (866) 349-3458 or
Email: design@filterra.com

Filterra® and Americast reserve the right to alter specifications without notice. Please make certain the Filterra® Project Information Sheet is completed to ensure the verification of the latest specifications for your project.



PLAN VIEW



SECTION A-A

DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
4 x 6	4'-0"	6'-0"	(1) 3x3	4" SDR-35 PVC
4 x 8	4'-0"	8'-0"	(1) 3x3	4" SDR-35 PVC
6 x 8	6'-0"	8'-0"	(1) 4x4	4" SDR-35 PVC
6 x 10	6'-0"	10'-0"	(1) 4x4	6" SDR-35 PVC
6 x 12	6'-0"	12'-0"	(2) 4x4	6" SDR-35 PVC

DRAWING AVAILABLE IN TIF FILE FORMAT.

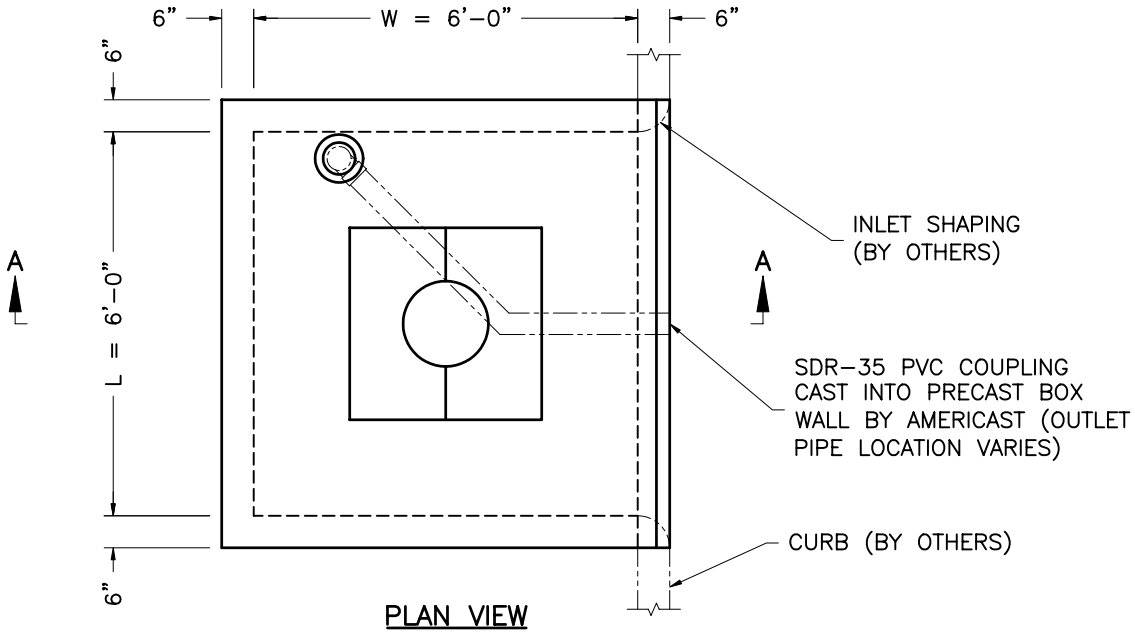
AMERICAST®

DATE: 12-22-04 | DWG: FTNL-2

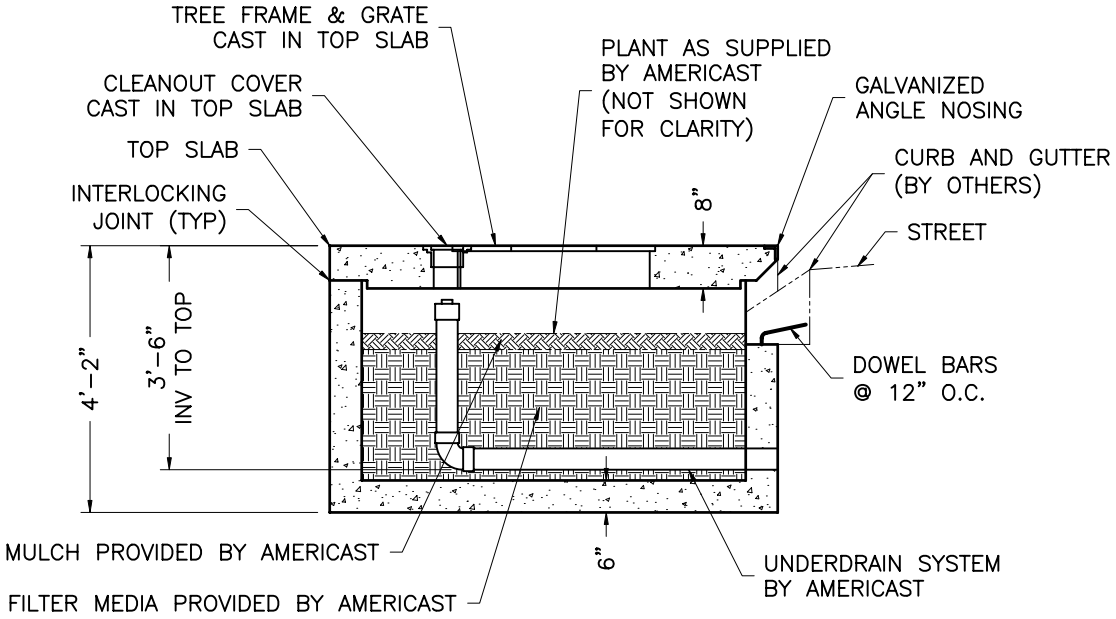
PRECAST FILTERRA® UNIT
NARROW LENGTH CONFIGURATION
MID-ATLANTIC REGION

filterra®

US PAT 6,277,274
AND 6,569,321



PLAN VIEW



SECTION A-A

DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
6 x 6	6'-0"	6'-0"	(1) 3x3	4" SDR-35 PVC

DRAWING AVAILABLE IN TIF FILE FORMAT.

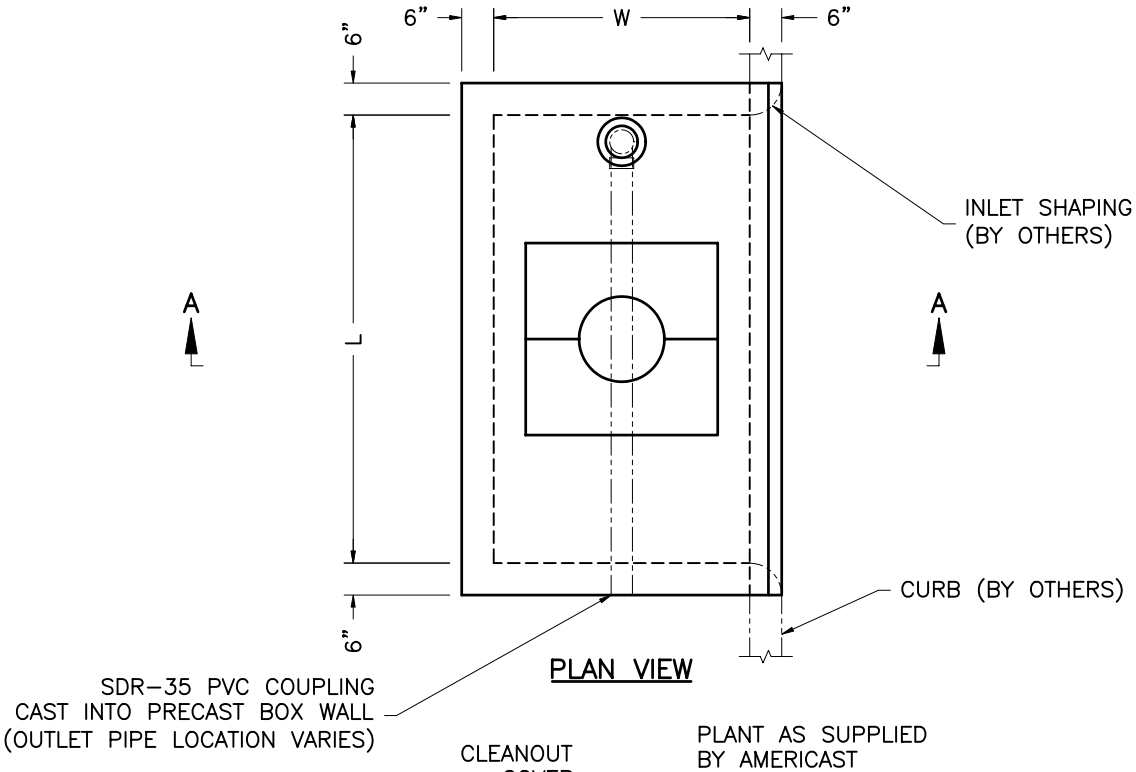
AMERICAST®

DATE: 12-22-04 | DWG: FTST-2

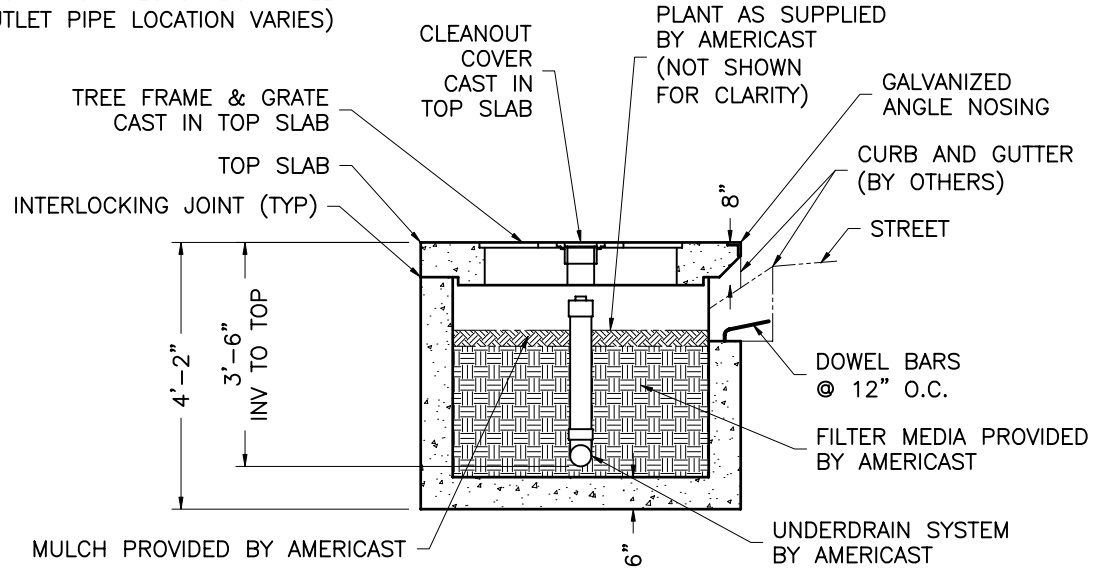
PRECAST FILTERRA® UNIT
STANDARD CONFIGURATION
MID-ATLANTIC REGION

filterra®

US PAT 6,277,274
AND 6,569,321



PLAN VIEW



SECTION A–A

DESIGNATION	L	W	TREE GRATE QTY & SIZE	OUTLET PIPE
6 x 4	6'–0"	4'–0"	(1) 3x3	4" SDR–35 PVC
8 x 4	8'–0"	4'–0"	(1) 3x3	4" SDR–35 PVC
8 x 6	8'–0"	6'–0"	(1) 4x4	4" SDR–35 PVC
10 x 6	10'–0"	6'–0"	(1) 4x4	6" SDR–35 PVC
12 x 6	12'–0"	6'–0"	(2) 4x4	6" SDR–35 PVC

DRAWING AVAILABLE IN TIF FILE FORMAT.

AMERICAST®

DATE: 12–22–04 | DWG: FTNW–2

PRECAST FILTERRA® UNIT
NARROW WIDTH CONFIGURATION
MID-ATLANTIC REGION

filterra®

US PAT 6,277,274
AND 6,569,321

Filterra Standard Plan Notes

Construction & Installation

A. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

B. If the Filterra® is stored before installation, the top slab must be placed on the box using the 2x4 wood provided, to prevent any contamination from the site. All internal fittings supplied (if any), must be left in place as per the delivery.

C. The unit shall be placed on a compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1- 2% of optimum moisture. Unsuitable material below sub-grade shall be replaced to the site engineer's approval.

D. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations.

E. Once the unit is set, the internal wooden forms and protective mesh cover must be left intact. Remove only the temporary wooden shipping blocks between the box and top slab. The top lid should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on top of the lid and boards sealed in the unit's throat must **NOT** be removed. The Supplier (Americast or its authorized dealer) will remove these sections at the time of activation. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6" lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of Filterra® unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures", unless directed otherwise in contract documents.

F. Curb and gutter construction (where present) shall ensure that the flow-line of the Filterra® units is at a greater elevation than the flow-line of the bypass structure or relief (drop inlet, curb cut or similar). Failure to comply with this guideline may cause failure and/or damage to the Filterra® environmental device.

G. Each Filterra® unit must receive adequate irrigation to ensure survival of the living system during periods of drier weather. This may be achieved through gutter flow or through the tree grate.

Activation

A. Activation of the Filterra® unit is performed ONLY by the Supplier. Purchaser is responsible for Filterra® inlet protection and subsequent clean out cost. This process cannot commence until the project site is fully stabilized and cleaned (full landscaping, grass cover, final paving and street sweeping completed), negating the chance of construction materials contaminating the Filterra® system. Care shall be taken during construction not to damage the protective throat and top plates.

B. Activation includes installation of plant(s) and mulch layers as necessary.

Maintenance

A. Each correctly installed Filterra® unit is to be maintained by the Supplier, or a Supplier approved contractor for a minimum period of 1 year. The cost of this service is to be included in the price of each Filterra® unit. Extended maintenance contracts are available at extra cost upon request.

B. Annual maintenance consists of a maximum of (2) scheduled visits. The visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excessive leaf litter.

C. Each maintenance visit consists of the following tasks.

1. Filterra® unit inspection
2. Foreign debris, silt, mulch & trash removal
3. Filter media evaluation and recharge as necessary
4. Plant health evaluation and pruning or replacement as necessary
5. Replacement of mulch
6. Disposal of all maintenance refuse items
7. Maintenance records updated and stored (reports available upon request)

D. The beginning and ending date of Supplier's obligation to maintain the installed system shall be determined by the Supplier at the time the system is activated. Owners must promptly notify the Supplier of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology.

Section D

Filterra® Technical Section

Table 2:
Expected Pollutant Removal Rates
Filterra Stormwater Bioretention Filtration System

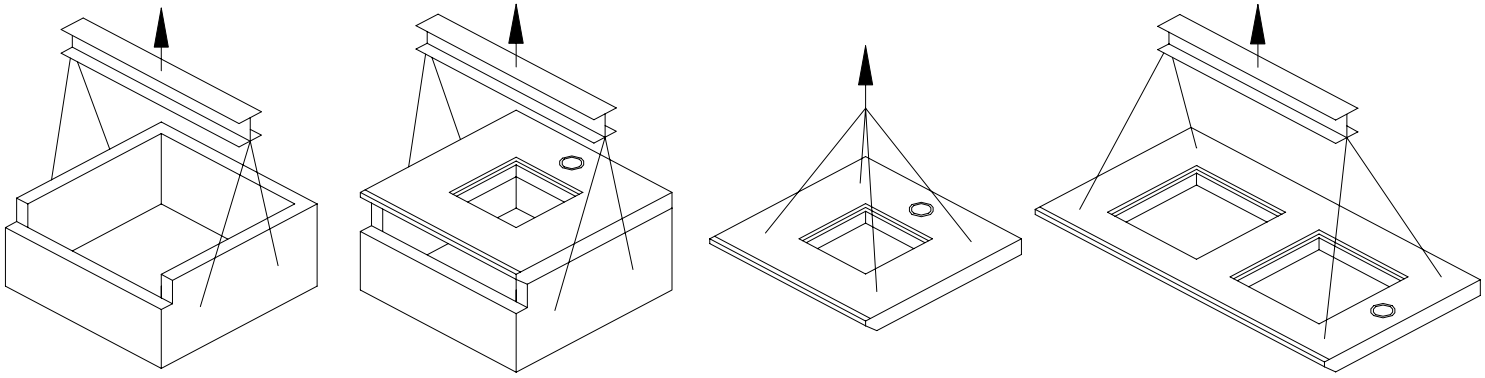
Based on a 0.33% FSA/DA ratio in Mid-Atlantic region

Annual Volume Percent filtered	90%
Total Phosphorus Removal	74%
Total Nitrogen Removal	68%
Total Suspended Solids Removal	88%
Metal Removal	82%

Information based on a two-year research study at the University of Virginia

Americast Filterra® Weights and Lifting Details

		Box Only		Top Only		Box + Top		Box + Media		Box + Media + Top		*Spreader Bar	
		Pounds	Tons	Pounds	Tons	Pounds	Tons	Pounds	Tons	Pounds	Tons	Min	Max
4'-0" Throat	4x6	7,440	3.72	2,819	1.41	10,259	5.13	12,624	6.31	15,443	7.72	5.00 ft	7.50 ft
	4x8	9,145	4.57	3,829	1.91	12,974	6.49	16,057	8.03	19,886	9.94	5.00 ft	7.50 ft
6'-0" Throat	6x4	7,285	3.64	2,797	1.40	10,082	5.04	12,469	6.23	15,266	7.63	5.50 ft	7.50 ft
	Std 6x6	**9,300**	**4.65**	**4,221**	**2.11**	**13,521**	**6.76**	**17,076**	**8.54**	**21,297**	**10.65**	**7.00 ft**	**9.00 ft**
	6x8	11,315	5.66	5,121	2.56	16,436	8.22	21,683	10.84	26,804	13.40	7.00 ft	9.00 ft
	6x10	13,330	6.67	6,545	3.27	19,875	9.94	26,290	13.15	32,835	16.42	7.00 ft	9.00 ft
	6x12	15,345	7.67	6,825	3.41	22,170	11.09	30,897	15.45	37,722	18.86	7.00 ft	9.00 ft
8'-0" Throat	8x4	8,835	4.42	3,787	1.89	12,622	6.31	15,747	7.87	19,534	9.77	5.50 ft	7.50 ft
	8x6	11,160	5.58	5,100	2.55	16,260	8.13	21,528	10.76	26,628	13.31	7.50 ft	9.50 ft
10'-0" Throat	10x6	13,020	6.51	6,503	3.25	19,523	9.76	25,980	12.99	32,483	16.24	7.50 ft	9.50 ft
12'-0" Throat	12x6	14,880	7.44	6,762	3.38	21,642	10.82	30,432	15.22	37,194	18.60	7.50 ft	9.50 ft

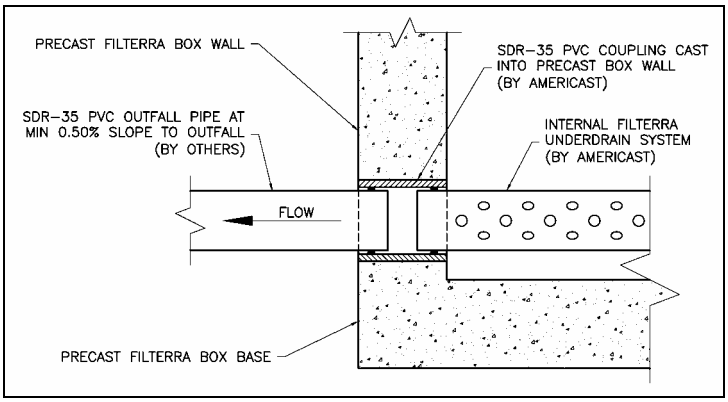


A 7.50 ft spreader bar is suitable for all sizes shown and is **always needed** for safe lifting of all box sizes

1/3/05

Filterra Piping Technical Details

Filterra® is supplied with an internal underdrain system that exits a wall in a perpendicular direction. Most efficient drainage is accomplished when the drain exits on the lower side of the Filterra®, i.e. nearest the overflow bypass. This is more important when using the larger sized Filterras®.



Drawing DP1: Section View through Filterra Precast Box Wall at Outfall Pipe Connection

All units are supplied with the drainage pipe coupling precast into the wall, at a depth of 3.50 feet (INV to TC). Drawing DP1 is a detail of the coupling. The coupling used is SDR-35 PVC.

Typically, a minimum slope of 0.50% is adequate to accommodate the flow of treated water from the Filterra®, but each site may present unique conditions based on routing of the outfall pipe (elbows). The pipe must not be a restricting point for the successful operation of Filterra®. All connecting pipes must accommodate freefall flow. Table 3 lists expected flow rates of the various size Filterra® units and these flow rates can be used to confirm or calculate the minimum outfall pipe slope.

Table 3: Filterra Flow Rates & Pipe Details

Filterra® Size (feet)	Expected Flow Rate (cubic feet/second)	Connecting Drainage Pipe
4x6 or 6x4	0.056	4” SDR-35 PVC
4x8 or 8x4	0.075	4” SDR-35 PVC
6x6	0.084	4” SDR-35 PVC
6x8 or 8x6	0.112	4” SDR-35 PVC
6x10 or 10x6	0.140	6” SDR-35 PVC
6x12 or 12x6	0.168	6” SDR-35 PVC

Filterra Plant Selections

The Filterra® Stormwater Bioretention Filtration System harnesses the power of nature to capture, immobilize and cycle pollutants to treat urban runoff. Trees, grasses and shrubs do more than make it attractive; they also enhance pollutant removal.

Above ground, the system's shrubs, grasses or trees add beauty and value to the urban landscape. Underground, nature's complex physical, chemical and biological processes are hard at work removing a wide range of non-point source pollutants from the treated stormwater. Pollutants are decomposed, volatilized and incorporated into the biomass of Filterra's micro/macro fauna and flora.

A wide range of plants are suitable for use in bioretention systems, and a list is available that indicates those suitable for use with Filterra®. The selection varies by location according to climate.

The most popular selections to date are shown below:

Filterra® with Foster Holly

Filterra® with Crape Myrtle

Filterra® with Red Osier Dogwood

Acronyms and Abbreviations

BMP		Best Management Practice
CB		Catch Basin
CI		Curb Inlet
CSO		Combined Sewer Overflow
CWA		Clean Water Act
DA		Drainage Area
DAKit		Design Assistance Kit for Filterra
DI		Drop Inlet
EPA		Environmental Protection Agency
FL		Flow Line
FSA		Filter Surface Area
FT		Filterra
IMP		Integrated Management Practice
INV		Invert of pipe
LID		Low Impact Development
MH		Manhole
NPDES		National Pollutant Discharge Elimination System
NRCS		Natural Resources Conservation Service
NURP		Nationwide Urban Runoff Program
SPCC		Spill Prevention, Control, and Countermeasures
SWMM		Storm Water Management Model
TC		Top Curb
TMDL		Total Maximum Daily Load
TN		Total Nitrogen
TP		Total Phosphorus
TSS		Total Suspended Solids